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ABSTRACT

This paper explores some problems of adaptation of curriculum materials that need to be faced by product developers and teacher trainers. It focuses on: a) developing teacher skill in purposeful variation, b) promoting adaptation of materials, and c) transforming available products. First, the Responsive Teaching project, designed to instruct teachers to vary their responses to pupils depending on the level of initiative that pupils display, is described, and three major decisions basic to program development and inherent in product development are discussed, including: a) determining the effective training strategy to promote the desired teacher skill, b) identifying a somewhat simplified organization of concepts for a complex training system, and c) selecting available products that are suitable to the training strategy and the organization of concepts. Second, an aspect of the Responsive Teaching package designed to encourage adaptation by the local user is used to illustrate the adaptation of training strategy, training sequence, and specific content. Third, an analogy between transformation of training products and transformation of language is examined. The effects of extensive transformation and skill development in adaptive arts are also discussed. A six-item bibliography is included. (PD)

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TRANSFORMING THE PRODUCT

Greta Morine

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TRANSFORMING THE PRODUCT

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For many years there has been a concerted effort by curriculum developers to produce "teacher-proof" materials. This movement was based on several assumptions:

1. that a particular curriculum in its pure form would be effective for a wide range of learners,
2. that variations in use of the curriculum would cause loss of effectiveness,
3. that teachers lacked the skill to consistently apply the curriculum in its pure form, and thus used it unreliably.

This restricted perception of the teacher's role as a curriculum agent has been expressed in two ways in the field of teacher training. First, it has led to the development of materials designed to train teachers to implement a given curriculum in a particular unvaried way. Second, it has led to the large-scale development of self-instructional teacher training materials, which are designed to prevent contamination of effectiveness by the teacher educator.

This paper is based on an alternative set of assumptions:

1. that any curriculum in its pure form can only be effective for a limited range of learners,
2. that planned variations in use of a curriculum will tend to increase the range of effectiveness,

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3. that teachers can develop skill in varying use of curriculum materials in ways that increase their effectiveness with particular learners (skill in "purposeful variation").

This perception can also be expressed in two ways in the field of teacher training. First, it suggests that purposeful variation is a basic teaching skill for which training materials need to be developed. Second, it suggests that we need large-scale development of training materials designed to promote adaptation by the local curriculum user, in this case the teacher educator, for training materials are to the teacher educator what curriculum materials are to the classroom teacher.

The truth is that no curriculum material can ever be used in its "pure form." It is necessarily changed by the very act of applying it in a given instructional setting. For example, every teacher training product is transformed whenever it is used in a local training program. The context of the training system within which the product is placed transforms the product, so that its meaning shifts from one program to another. The position that the product occupy] within the training system also transforms it, so that the function of the product will be different depending on whether it is used early or late in the training program. In addition to these contextual and functional transformations, many training products are changed in other ways by the local user. They may be used in part rather than in entirety. They may be supplemented by additional information or additional opportunities for practice.

On the other hand, there are factors that prevent extensive transformation of training products. There have been complaints by some local users that training products developed by the regional labs and centers are not readily adaptable to maximize attainment of local program

goals. To some users the products have a very finished appearance, and the field test data provide an intimidating warning not to tamper with materials of proven effectiveness.

The facts of both biological and institutional life are that no organism can long survive unless it has developed some mechanism for adaptation. Similarly, the effective life of a teacher training product will be very brief, no matter how long its gestation period or how costly its birth, if it cannot be adapted or transformed to suit the local climatic conditions. Therefore, the transformation of training products, in addition to being unavoidable, is a necessity for the local user and a "consummation devoutly to be wished" by the product developer.

This paper will explore some problems of transformation or adaptation of curriculum materials that need to be faced by both product developers and teacher trainers. Three major questions will be considered in the course of describing the development of a particular training system. These questions are:

1. How can we train teachers to develop their skill in purposeful variation in use of curriculum materials?
2. How can we design training products that promote adaptation of the materials by the teacher educator for use in the local program?
3. How can we efficiently transform available teacher training products for incorporation into new training systems?

In discussing the last question, an analogy will be presented as a means of attaining a new perspective of the transformation process and providing conceptions that can assist the teacher, the teacher educator, and the product developer in becoming more adept at treating curriculum products as transformable organisms in the educational microcosm.

Developing Teacher Skill in Purposeful Variation

The Bay Area Teacher Training Complex, a joint project of the Far West Laboratory and the Oakland Unified School District, funded by the U.S. Office of Education, is currently developing a training system on Responsive Teaching. The major purpose of the package is to increase pupil initiative in various instructional settings. The training is designed to instruct teachers to vary their responses to pupils depending upon the level of initiative that pupils display. Purposeful variation in the context of this training system means variation of teacher response to pupil questions and comments for the purpose of increasing pupil initiative.

The Responsive Teaching project was conceived as a project in "transformational development." That is, it was intended from the beginning that much of the final training system would consist of previously developed products which had been adapted slightly to better fulfill the specific goals of this particular training system. For this reason the project has faced some decisions basic to program development, as well as those decisions inherent in product development. The three major decisions to be discussed here are: determining the most effective training strategy to promote the desired teacher skill; identifying a somewhat simplified organization of concepts for a complex training system; and selecting available products that are suitable to both the training strategy and the organization of concepts.

Training Strategy

Since the purpose of the Responsive Teaching package is to develop teacher skill in varying responses to pupils in order to increase pupil initiative, certain training strategies are clearly inappropriate. For example, modeling use of a particular responsive skill for imitation by a trainee might promote teacher use of that skill, but it would not be apt to encourage teacher adaptation of the skill for varied use with different pupils. The principal training strategy for the Responsive Teaching package is comparison of alternative procedures. Each instructional strategy is introduced not in isolation, but in contrast to another useful strategy. Each responsive skill is taught not as a unitary technique, but as a set of variations on a response. Each opportunity to practice a newly-learned strategy or skill is constructed not as a single microteach lesson, but as a pair of lessons in which the effects of different teaching styles can be compared.

Organization of Concepts

When variation is the theme, as is the case in the Responsive Teaching package, the complexity of a training system is greatly magnified. Some means of simplification must be sought. A limited number of concepts closely related to the training goal must be identified. The components of the training system must then be organized to clarify these concepts in progressively increased detail.

The principal organizing concept in the Responsive Teaching package is pupil initiative, which is defined as the ability of the pupil to provide structure of either a social or cognitive nature. A pupil with little initiative requires much more structuring by the teacher if he is

to interact productively in a social situation or to think productively in a conceptual situation. The major variation in response that a teacher can make related to pupil initiative, therefore, is to vary the amount of structure provided for the pupil.

Structure can be varied in relation to many different instructional strategies. For the Responsive Teaching package at present two strategies have been selected for comparison. The two strategies develop pupil skill in concept learning in a small group setting, thus they provide opportunities to vary both social and cognitive structure. One strategy deals with concept formation, the other with concept attainment. They are both familiar to many teacher educators as the Taba Model and the Bruner Model (Joyce and Weil, 1972). The two models or strategies differ in the amount of structure they provide, with concept formation requiring more pupil initiative than concept attainment. In addition each strategy can be modified to provide more or less structure of either a cognitive or a social nature. Variation in structure can be provided in relation to data organization, feedback on data interpretation, and method of concept testing, and this variation can occur both between models and within models.

Assessment of the effects of variation is accomplished by comparison of pupil learning in two alternative lessons, which differ in the amount of structure provided. Pupil learning of both the concept under investigation and the process of concept attainment or concept formation is assessed. Curriculum materials are provided for teacher use in planning these comparative lessons, and the teacher may choose among three content areas--social studies, linguistics, and mathematics.

To recapitulate, the Responsive Teaching package is organized around six key concepts. Pupil initiative is expressed as a variation

in need for structure. Within the task requirements of concept learning, the teacher response can be to provide variation in the amount of structure provided by data organization, feedback on data interpretation, and concept testing procedures in order to increase pupil initiative. Comparison of alternative amounts of structure permits assessment of the effects of this purposeful variation.

The chart on the following page identifies the components of the Responsive Teaching package. Their titles and objectives indicate the relationships between these components and the organizing concepts.

Selection of Products

When this project in transformational development was first conceived, it was expected that there would be a number of available products related to teacher responsiveness that could be utilized within the package. However, as the goals and training strategy became more and more clearly defined, the number of suitable products became more and more limited. Finally, the criterion for selection became rather specific. To be incorporated into this particular training package, a product had to:

1. utilize or readily allow a comparative approach to instructional strategies, rather than present a strategy as the "preferred" method of instruction,
2. relate to or explicate one or more of the key organizing concepts of the package,
3. permit easy selection of a particular segment, or be compact enough in its entirety to form a module of reasonably brief length for a package composed of several modules.

RESPONSIVE TEACHING: TRAINING FOR PURPOSEFUL VARIATION

Components	Objectives	Suitable Products Available	Needed Changes	Transformation Operation**
Comparative Observation: Assessing Variations in Teaching Style	1. to generate concepts with which to view variations in teaching style. 2. to develop and use a simple observation system. 3. to generate and test alternative procedures for teaching the same content.	*BATTC, Entry Module	New directions needed to increase emphasis on assessing variations in opportunity for expression of pupil initiative.	Expansion
Concept Formation and Concept Attainment: Comparing Learning Processes	1. to analyze the effects of different types, amounts, and organization of data upon concepts developed. 2. to differentiate between convergent and divergent concept development.	SRA, Three Teaching Strategies. *Prentice-Hall, Discovery	concept learning exercises needed more variety in media used to present data, to demonstrate effects of different types of variation.	Component Form
Concept Formation and Concept Attainment: Comparing Teaching Processes	1. to plan and manage lessons designed to promote pupil ability to organize data and produce concepts (concept formation strategy). 2. to plan and manage lessons designed to promote pupil ability to identify and use concepts (concept attainment strategy). 3. to compare the two teaching strategies.	*SRA, Three Teaching Strategies. NW Lab, Development of Higher Level Thinking Abilities. *Prentice-Hall, Discovery	two teaching strategies needed to be taught in comparative manner, rather than in isolation. strategies needed to be illustrated with subject matter content to be used in later application.	Component Order Substitution
Concept Formation and Concept Attainment: Comparing Curriculum Applications	1. to compare the concept formation and concept attainment strategies as applied to different subject matter content (social studies, mathematics, linguistics). 2. to develop knowledge of topics to be used in later practice lessons.			

* Products selected for inclusion.
** See discussion in Section Three.

Components	Objectives	Suitable Products Available	Needed Changes	Transformation Operation
Student Learning Style: Assessing Variations in Need for Structure.	1. to diagnose student learning style (need for structure) on the basis of pupil behavior in concept learning settings.			
Concept Learning, Phase I: Varying Structure in Data Organization	1. to develop skill in responding to data provided by pupils. 2. to vary organization of data depending on teaching strategy. 3. to observe the effects of varying amounts of structure within each strategy.			
Concept Learning in Action (I): Assessing Effects of Variation in Data Organization	1. to plan and conduct two lessons, practicing skill in organizing data. 2. to vary the amount of structure provided in two lessons. 3. to observe the effects of varying amounts of structure on pupil behavior and pupil learning.	*Programmed Instruction Units in Linguistics *Data Banks in Social Studies	specific content needed to be selected for microteach lessons. suggestions to teacher for opportunities to practice variations needed to be provided.	Contraction Expansion
Concept Learning, Phase II: Varying Structure in Feedback on Data Interpretation	1. to develop skill in providing pupils with feedback on their interpretations of data. 2. to vary type of feedback depending on teaching strategy. 3. to vary type of feedback providing differing amounts of sturcture within each strategy.			
Concept Learning in Action (II): Assessing Effects of Variation in Feedback on Data Interpretation	1. to plan and conduct two lessons, practicing skill in giving feedback on data interpretation. 2. to vary the amount of structure provided in two lessons. 3. to observe the effects of varying amounts of structure on pupil behavior and pupil learning.	*Linguistics Units *Data Banks	specific content needed to be selected for microteach lessons. suggestions to teacher for opportunities to practice variations needed to be provided.	Contraction Expansion

Components	Objectives	Suitable Products Available	Needed Changes	Transformation Operation
Concept Learning, Phase III: Varying Structure in Concept Testing	1. to develop skill in encouraging pupils to test the concepts they develop. 2. to vary concept testing method depending on teaching strategy. 3. to vary concept testing method providing differing amounts of structure within each strategy.			
Concept Learning in Action (III): Assessing Effects of Variation in Concept Testing	1. to plan and conduct two lessons, practicing skill in encouraging concept testing. 2. to vary the amount of structure provided in two lessons. 3. to observe the effects of varying amounts of structure on pupil behavior and pupil learning.	*Linguistics Units *Data Banks	specific content needed to be selected for micro-teach lessons. suggestions to teacher for opportunities to practice variations needed to be provided.	Contraction Expansion

In addition, while it was never a conscious criterion, we cannot help noting in retrospect that the products selected for transformation were all products with which we were thoroughly familiar, having in many instances taught with them. Familiarity with product is probably an essential requirement for effective transformation, and this point will be discussed in more detail in a later section of this paper.

The specific products deemed suitable and those finally selected for inclusion in the Responsive Teaching package are listed in the chart on the preceeding page. In each case some change in product was necessary and these changes are also noted in the chart. Where no products are listed, it was necessary for us to develop a specific module to fulfill the objectives of that particular component. That development is currently in progress.

The Answer?

Clearly it is too soon to say that we have answered the question: "How can we train teachers to develop their skill in purposeful variation in use of curriculum materials?" We must wait for the field test of the final product. However, we have hypothesized one possible answer to the question and it is exemplified in our development of the Responsive Teaching package. We are, in effect, betting our money that a training strategy based on comparison of alternative procedures, a careful organization of key concepts, and a critical selection, adaptation, and production of components suitable to both the training strategy and the organization of concepts will do the job.

Promoting Adaptation of Materials

The typical teacher training product is designed to be used in a particular way and the field testing of products is planned to assess the effectiveness of the product, so that it can be stamped with the Good Housekeeping seal and "guaranteed effective when used as directed." As noted earlier, no product can be used within a training program without some change in its meaning and, therefore, in its effectiveness. But beyond that there are many instances where products need to be adapted somewhat to suit the unique training goals of a particular program. It is possible for the product developer to assist in that process, though few developers have taken advantage of the opportunity to date.

To illustrate one approach to this problem, we can examine another aspect of the Responsive Teaching package, which is designed in part to encourage adaptation by the "local user," whether that be the teacher educator who is administering the package or the teacher trainee who is engaged with the materials. There are three points where adaptation is particularly invited, and there are three types of possible adaptation.

Adaptation of Training Strategy

The introductory module, "Comparative Observation: Assessing Variations in Teaching Style," is designed to permit adaptation through selection of alternative instructional formats. Trainees are introduced to the process of observing variations in teaching style by two sets of materials which assist them in developing categories (or concepts) of teaching behavior to guide their observation. One option is a programmed instruction booklet which can be used by the trainee alone or with a

partner. The other option is a discussion guide which can be used by an instructor with a small to moderately-sized group, or by a group of trainees operating alone. Both instructional procedures result in the production of a simple category system designed by the individual trainee for the purpose of observing his/her own teaching behavior.

This type of product design permits the local user to select the instructional format according to a number of possible criteria, such as which format will be most supportive of program goals, or which format will provide the most instructional variety, or which format is most responsive to the preferred learning style of the individual trainee. Providing this alternative necessitates an additional wrinkle in the field test procedure, but it need not be an expensive or complex addition. In this particular case the two alternative formats were tested with different groups of inservice teachers to determine whether they did indeed lead to similar output and were equally palatable to teachers. The materials and the field test have been more fully described elsewhere (Morine, 1973).

Adaptation of Training Sequence

Both the introductory module just discussed and the module on "Student Learning Style: Assessing Variation in Need for Structure" are designed to permit adaptation by reorganization of training sequence. The first allows for variation in sequencing of materials within a single module. The second allows for variation in placement of a particular module within the training system.

The three major instructional activities of the introductory module on observing variations in teaching style involve: developing a simple

observational system; planning, teaching, and analyzing two lessons in an attempt to vary the method of teaching a particular concept; analyzing four videotaped lessons in which instructional method is varied while content remains essentially the same. The module is designed so that these activities can be engaged in in any order. For example, instead of the sequence given above, a trainee might begin by analyzing the four videotaped lessons, then move to developing an observational system and teaching his own two comparative lessons. To field test the effectiveness of alternative sequences, the developer must have different groups of teachers use the materials in different orders and demonstrate that the behavioral outcomes are similar regardless of order. Our field test of this particular module did indicate this similarity (Morine, 1973).

In the chart outlining details of the Responsive Teaching package, the module on student learning style follows comparison of the two instructional strategies, and preceeds exploration of the variations of particular skills that permit modification of each strategy. This placement is based on the idea that the trainee ought to understand the instructional purpose of variation before studying the more fine-grained aspects of the technique of variation. However, a case can be made for an alternative placement of this module between "Concept Learning, Phase I" and "Concept Learning in Action (I)," on the grounds that development of skill in diagnosing pupil need for structure should be followed as closely as possible by application of that skill in interaction with pupils.

Both sequences seem rational. In this case their effects may be slightly different, in that the first organization may promote more skill in techniques of varying data organization, while the second may promote

more skill in diagnosing student learning style. The decision of which sequence to use could be made by the developer, but adaptation by the local user can be encouraged by field testing the materials under both organizational conditions and reporting the comparative results to the potential user so that he can make an informed decision based on his own program priorities. This latter procedure is the one we hope to follow in our summer field test of the Responsive Teaching package.

Adaptation of Specific Content

The three modules on "Concept Learning in Action" are designed to permit adaptation through selection of specific content to be covered in the microteach sessions. In this case the adaptation would probably be made by the teacher trainee rather than the teacher educator. In each module the trainee is provided with curriculum materials to use with pupils, and the particular concept to be attained or the topic around which concepts are to be formed is specified. Three curriculum areas are covered. Data on a medieval town in England are provided for use by the trainee who wishes to teach social studies concepts. Materials on linguistics are provided for use by the trainee who wishes to teach language concepts. Materials on a mathematical system called a lattice are provided for use by the trainee who wishes to teach mathematics concepts. In each case the curriculum content is atypical of normal classroom curriculum so that the teacher will feel free to experiment with teaching strategy without worrying about detriments to pupil understanding of basic "required" concepts. The content has also been selected because it can be used readily with children from grades three through six, and it can be presented effectively in either concept attainment lesson or concept formation lessons.

Providing this option of subject matter content to be taught by trainees adds some complexity to the Responsive Teaching package. Since all of the specific topics are rather uncommon, the trainee must be introduced to them early and must develop some confidence in his knowledge of the concepts contained in the materials. To accomplish this the three content areas are used throughout the package in various ways. The four alternative lessons presented for analysis in the introductory module all deal with the topic "Operations on a Mathematical Lattice." The module on "Concept Formation and Concept Attainment: Comparing Teaching Processes" exemplifies the two instructional strategies through a videotape of two lessons on the medieval English town. The module on "Comparing Curriculum Applications" presents additional examples of lessons on linguistics and the lattice, using both instructional strategies in each content area. The three modules on "Concept Learning (Phase I, II, and III)," which present variations in use of particular responsive skills, use examples throughout based on content in linguistics and the lattice.

It is expected that this series of presentations of the content areas will serve to make the teacher trainee comfortable enough with the various topics to exercise the option to explore different subject areas that the package provides. This is one of the questions that the summer field test will have to answer. The point to be made in relation to encouragement of adaptation, however, is that providing an opportunity for adaptation of specific content, at least in this instance, requires much more planning and additional effort by the developer than the other two forms of adaptation.

Transforming Available Products

There are varying degrees of transformation or adaptation of products that occur with incorporation of a product into a local program or a new training system. In the case of development of the Responsive Teaching package a moderate degree of transformation was necessary with every product selected for inclusion. It would be possible to discuss the transformation process simply in terms of these specific changes, but it seems more productive to attempt a general perspective.

An analogy is a useful tool to provide such a perspective. It can enable us to see new facets of a familiar process and may provide clues for reconcepualization. We test the effectiveness of an analogy by the clarification it produces. One analogy that seems to have interesting possibilities is a comparison between transformation of training products and transformation of language. Let us examine the ideas that might develop out of such a comparison.

The Analogy

We are all practitioners of the art/science of linguistic transformation. It is a skill we mastered at a very early age. Most of us have never bothered to explicate the linguistic operations that we use or the properties (rules) that govern our use of these transformational operations. But once they are explicated to us they are easily recognizable and familiar. For this reason the process of linguistic transformation seems to provide an excellent analogy from which we can attain a new perspective of the process of transforming training products.

A sentence can be compared to a training product. A sentence is a mini-system of communication that functions within the context of a paragraph or a conversation to convey a message. A training product is a mini-system of instruction that functions within the context of a training program to convey concepts and skills. A sentence can be analyzed to determine how its individual words contribute to understanding of the message. A training product can be evaluated on the basis of its ability to elicit mastery of concepts and skills. A sentence can be transformed. So, clearly, can a training product.

Why Do We Transform?

We transform a sentence because we want to change its meaning, either to carry a more explicit message or to carry a modified message. We transform a training product for the same reason. We want to shift its meaning or vary its effect in order to increase the effectiveness of the total training program.

There are two types of meaning in a sentence--lexical meaning and structural meaning. We can transform the meaning of a sentence by changing either type of meaning. For example, when we shift from saying, "Teacher training is effective," to asking, "Is teacher training effective?" we have changed the structural meaning of the sentence. When we shift from saying"Teacher training is effective," to saying, "Teacher training is impossible," we have changed the lexical meaning of the sentence. When we shift from saying, "Teacher training is effective," to asking, "Is teacher training impossible?" we have changed both structutal and lexical meaning, and the result is a much more extensive transformation.

There are also two types of meaning in a training product--conceptual meaning and procedural meaning. We can transform the meaning of the product by changing either type of meaning. For example, we could change the conceptual meaning of the Minicourse on Effective Questioning by adding a lesson on the effects of alternative sequencing of lower order and higher order questions, comparing the effects of a series of lower order questions followed by a higher order questions to the effects of a higher order question followed by a series of lower order questions. We could change the procedural meaning of that Minicourse by having trainees receive feedback on their microteach lessons from peer groups rather than from videotapes. Either transformation would change the learning that resulted from use of the product. If we made both changes we would have a quite different product than the one with which we began.

What Are the Operations That Transform?

The operations that we use to transform sentences can affect either structural or lexical meaning. The most commonly used operations are substitution, expansion, contraction, change in word order, and change in word form. The following examples illustrate these operations, applied to the sentence, "Teachers affect their pupils."

Substitution: Teachers understand their pupils.

Expansion: Teachers sometimes affect their pupils.

Contraction: Teachers affect pupils.

Word Order: Pupils affect their teachers.

Word Form: Teachers affected their pupils. (Remember the good old days?)

Each of these operations changes the meaning of the original sentence. You will note that some operations change the meaning more than others. We select an operation depending upon the kind of meaning change we wish to make.

The same operations can be used to transform training products. In this instance too we select an operation to suit our purpose, to change the meaning of the product in a particular way. To illustrate the several operations applied to product transformation we can examine the changes that are being made in the products incorporated into the Responsive Teaching package. (See chart on pg. 7a, 7b, 7c.)

Expansion. The "Entry Module," originally developed by the Bay Area Teacher Training Complex for general use in introducing teachers to observation of their own teaching behavior, needed a change in meaning to become an effective introductory module for the Responsive Teaching package. The revised module required an increased emphasis or a focusing of attention on variation in teaching style for the purpose of varying opportunity for expression of pupil initiative. The change in effect is to introduce teachers to purposeful variation rather than to variation for its own sake. This change in meaning is accomplished by the operation of expansion. It involves adding further structure in the form of new directions to the trainee for each activity in the module.

Component form. The concept learning exercises included in the book Discovery: A Challenge to Teachers (Morine and Morine, 1973) were designed to demonstrate the effects of varying amounts of structure on concept learning processes. However, all of the materials used are in printed

form. The point of effects of variation can be made much more clearly if the variation is more extensive. Therefore, it was decided to revise these exercises by using slides instead of printed pictures, an audio tape in place of printed music, and a set of concrete manipulable materials as a substitute for a pictorial display of such materials. The change in effect is to introduce teachers to the effects of variation in form of data as well as variation in structure or organization of data. This change in meaning is accomplished by the operation of changing component form. It involves a transformation of the form of materials to be used by the teacher trainee.

Component order. The module that is to introduce teachers to concept formation and concept attainment as teaching strategies will utilize training materials from two sources: the SRA product on Three Teaching Strategies (Joyce and Weil, 1972) and the previously mentioned book, Discovery: A Challenge to Teachers. In each case the teaching strategy is presented in addition to other strategies, but each strategy is considered separately, and comparison of strategies is not a heavily emphasized aspect of training. To further emphasize the comparative process as an effective method of studying variation in teaching style, it was decided to revise these products by presenting the two strategies in comparative fashion. Rather than learning the two strategies in sequence, one after the other, teachers will learn them simultaneously, and clarify them by contrasting them. The change in effect is to promote the attitude that comparison is a useful analytic tool. This change in meaning is accomplished by the operation of changing component order. It involves a shift in the order of presentation of instructional materials.

Substitution. This particular module also required one other transformation of products. In the original training materials the two instructional strategies were illustrated with a variety of curriculum topics. The Responsive Teaching package requires teachers to become familiar with three particular curriculum topics, which they might use in their microteach lessons. As noted earlier, it was decided that these topics should be introduced early and used to exemplify teaching strategies and skill variations. Therefore, the substitution operation was used, and the training products were revised to include illustrations based on teaching concepts related to a medieval English town, linguistics, and a mathematical lattice.

Contraction. The three curriculum topics to be used in microteach lessons were selected because they were both atypical and adaptable for various grade levels and teaching strategies. For each topic a set of curriculum materials existed for use by children, although in the case of the lattice these were not written materials. To incorporate these products into the Responsive Teaching package it was necessary to limit the amount of content teachers would be asked to cover in the microteach lessons. It was decided that the content should be of a general, introductory nature, since pupils might be taught only three lessons in the topic area. On this basis specific content was selected for each topic and the remaining available curriculum materials were "discarded." The change in effect for both the teacher trainee and the pupils is to increase the exploratory nature of the microteach lessons. This change in meaning is accomplished by the operation of contraction. It involves deletion of some part of the product being adapted.

Contextual transformation. Earlier the point was made that a training product was necessarily transformed whenever it was placed in the context of a new training system. This point can now be illustrated by use of our analogy. In addition to the five operations discussed above, a sentence can be transformed by placing it in a new context. For example, let us consider the sentence, "We need more trained teachers." We can shift its meaning by placing it in the context of two different paragraphs:

1. We need more trained teachers. We need them the way we need more air pollution, an extended population explosion, and a new Arab-Israeli war. And our schools of education are responding to this need, continuing to produce newly credentialled teachers as surely as our factories continue to produce smog.

2. We need more trained teachers. Not more teachers, but more trained teachers. We need teachers whose skills have been updated, teachers who can cope with the problems of education in a society shaken by future shock.

Contextual transformation is an inevitable result of placing a sentence in a new paragraph and of placing a training product in a new training system. Each of the products chosen for incorporation into the Responsive Teaching package has undergone some transformation in addition to the planned changes discussed above, because each product is now surrounded by additional products that reinforce selected meanings.

Non-analogous Aspects of Transformation

When we use an analogy as a tool to clarify our thinking and assist in describing an event or process, it is important that our comparison indicate points of dissimilarity as well. Let us take particular note here that if we simultaneously use all five operations in transforming a sentence, we change the meaning so greatly that it is difficult to recognize that one sentence is derived from the other. For example, if we apply all five operations to the sentence,

Learning outcomes are closely related to pupil skills.

we can arrive at the transformed sentence,

Someday teaching skills will be related to pupil outcomes.

This extensive transformation takes us in five simple steps* from a statement of one of the few established "truths" of educational research to a statement of what many consider to be an elusive mirage tempting educational researchers ever deeper into the desert of nonproductive investigation.

However, if we apply all five of the transformational operations discussed earlier to a single training product, we find that we still have a recognizable product despite the several changes. While it is not

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* Learning outcomes are closely related to pupil skills.
Contraction: Learning outcomes are related to pupil skills.
Word Form: Learning outcomes will be related to pupil skills.
Word Order: Learning skills will be related to pupil outcomes.
Substitution: Teaching skills will be related to pupil outcomes.
Expansion: Someday teaching skills will be related to pupil outcomes.

probable that such an extensive adaptation of a product would occur very frequently as a result of local use of a product, it is possible for us to transform a product in a variety of ways and still retain much of the meaning or message of the original. This fact can be illustrated by considering the possibilities of adapting the Minicourse on Independent Learning for inclusion in the Responsive Teaching package.

One type of pupil initiative that teachers can learn to support and increase is pupil ability to direct their personal learning activities. The Far West Laboratory's Minicourse on Organizing Independent Learning: Intermediate Grades is a product that trains teachers to negotiate learning contracts with pupils and to manage an instructional environment where part of the curriculum is based on this approach to individualized learning. This Minicourse could be transformed or adapted in various ways before its inclusion in the Responsive Teaching package, to better facilitate attainment of the goals of the new training system. Let us examine some of the possibilities in terms of the five transformational operations.

Substitution. The contract form presented in the Minicourse is rather open and assumes that the teacher in the interaction of negotiating the contract will provide additional guidance to pupils who need more structure. This could have the effect of continuing pupil dependence on the teacher, since the low-initiative pupil would have a great deal of difficulty tackling this open contract form on his own. To facilitate the training purpose of enabling teachers to increase pupil initiative we could transform the Minicourse by substituting a group of optional contract forms for the one form originally provided. The optional

forms would vary in the amount of structure they provided to the pupil. For the more dependent pupil two or three behavioral objectives could be pre-stated as stems with open endings to be completed by the pupil. Several types of possible resources could be listed for the pupil to choose from, then specify a particular resource of that type. A variety of outcome types could also be listed to structure possibilities. Finally, the section for scheduling checkpoints could be organized so that the low-initiative student indicated a task to be accomplished each day.

This kind of substitution would provide the teacher trainee with an opportunity to practice varying the amount of structure provided by curriculum materials, so that pupils of low initiative would have more guidance from the materials, could pre-plan part of their independent learning project before meeting with the teacher in a contract negotiation, and could gradually rely less on teacher guidance.

Expansion. The Minicourse provides teacher trainees with instruction on stating behavioral objectives. It is assumed that teachers will then use this skill to help pupils restate their goals for independent learning in specific, measurable terms. This component of the Minicourse could be expanded to further increase pupil initiative by providing additional instructional materials that would also teach the pupils to state objectives in behavioral terms. Pupils would thus develop a skill that would assist them in further independent planning of personal activities, and they would not need to rely on the teacher to help them restate and clarify their objectives.

Contraction. The Minicourse includes a section that trains teachers to discriminate between pupils who will need a great deal of teacher guidance in planning and implementing learning contracts, and pupils who will need little assistance. The discrimination measures relate specifically to use of learning contracts and include such items as: specificity of learning objectives stated by by the pupil; variety of resources identified by the pupil; clarity of procedural steps outlined by the pupil. As part of the Responsive Teaching package teachers will learn to discriminate between pupils of high and low initiative, using more general observational measures of student learning style, or need for structure. This training will occur early in the sequence of instructional activities, before teachers begin to investigate particular teaching strategies. The discrimination training in the Minicourse would therefore be largely redundant when the Minicourse was used as part of the Responsive Teaching package, and it would be appropriate to transform the Minicourse by contraction, removing the section on diagnosing pupil need for teacher guidance.

Component order and component form. The Minicourse is designed around a training procedure that involves viewing a model teacher displaying particular skills, practicing those same skills in a microteach lesson, evaluating the results, and reteaching a similar lesson in order to improve use of those skills. This procedure involves both an order ot training (view model, microteach, get feedback, evaluate, reteach) and a form of training (repeated attempts to approximate a prescribed model of skill use).

The training strategy used in the Responsive Teaching package involves comparison of alternative patterns of responding to pupils, with the criterion of effectiveness being an increase in pupil initiative. The change in component form therefore, is a shift from repeated attempts by a teacher trainee to approximate a prescribed model of skill use to repeated investigations by a teacher trainee to determine which of two alternative patterns of skill use is more effective with pupils who demonstrate a need for a particular amount of structure. This change in component form also involves a change in component order. In the original Minicourse the order of skill practice is: plan → microteach → get feedback → evaluate → replan → reteach. In the transformation to use of inquiry projects the order of skill practice becomes: plan → microteach 1 → microteach 2 → get feedback → evaluate. The comparison of the microteach lesson to a model of skill use in the original Minicourse procedure makes feedback and evaluation an essential intermediate step in the practice sequence. The comparison of two alternative patterns of skill use in the Responsive Teaching procedure makes feedback and evaluation more productive as a final step in the practice sequence. The shift in Minicourse procedure to use of comparative analysis as a training strategy that will further reinforce the goal of purposeful variation is, therefore, a product transformation that is accomplished by changing both component order and component form.

Effects of extensive transformation. Adaptation of the Minicourse on Independent Learning could utilize all five transformation operations simultaneously. This extensive transformation could make the Minicourse

a much more effective component of the Responsive Teaching package. But it would not make the Minicourse unrecognizable. Extensive transformation of a product does not have quite the same effect as extensive transformation of a sentence.

How Does One Learn to Transform?

The craft of the effective writer or conversationalist lies in his/her ability to manipulate language, inventing it and adapting it as necessary to identify, clarify, and underscore an important idea. The craft of the effective teacher educator lies in his/her ability to manipulate training materials, inventing them and adapting them as necessary to delineate, illustrate, and instigate applications of important concepts and skills. Manipulation of language is a craft we all have mastered. Manipulation of training materials is a craft that has as yet been practiced by very few. We could all benefit by increased skill in this form of the adaptive arts. But how might such skill be developed?

We learn to transform language by first learning the individual units of meaning (words) and the structural forms (basic sentence patterns). A baby can speak single words to which meaning is attached and can utter sequences of sound with the inflectional patterns of statements and questions. From this early beginning we practice by sending and receiving very simple, then gradually more and more complex messages. As we send messages we test our skill by gathering feedback in the form of active or verbal responses from our listeners. As we receive messages we improve our skill by comprehending meaning that is conveyed in a variety of ways.

It might be productive to teach ourselves to transform training products in the same way we taught ourselves to transform language. We would first have to become thoroughly familiar with both the individual components of products and the various procedural forms. We would have to practice sending meaning by transforming a product, and testing it to determine whether it conveyed the intended meaning to others. We would have to practice receiving meaning by working through products developed or transformed by others to determine what messages they carried for us. A thorough knowledge of a wide variety of products and training procedures from the perspective of both trainer and trainee is probably a prerequisite to competent transformation of training products.

The first rule of transformational development is undoubtedly: Familiarity breeds facility. But as we try to teach ourselves the transformational process, we will quickly discover that a knowledge of products, rules, and operations is not enough. A baby learns to speak because everything in his social system rewards and encourages that learning. If teachers, teacher educators, and developers are to learn to transform products, the social system must reward and encourage them. At present such encouragement does not exist. But it could be provided. We would need training products that encouraged teachers to develop skill in purposeful variation of curriculum materials. We would need tested training products that encouraged adaptation by the local user. We would need funded development projects that encouraged transformation of available products for incorporation into new training systems. The transformational development project described here is only a small step, but it is a step in the right direction, if adaptation or transformation is indeed our goal.

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Competency Check

Are you an adept adapter?

Do you deftly change the drift?

Can you trickily transform training

And adroitly manuever the shift?

Do your talents extend to expansion?

Are you snappy at snipping too?

Then a critical craft has been mastered

And you're one of a facile few.